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UNITED STATES DEPARTMENT OF AGRICULTURE  
FOREST SERVICE

THIRTEENTH REPORT  
OF THE  
CENTRAL STATES FOREST EXPERIMENT STATION  
(For the year 1941)



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GENERAL

Lumber production goals for 1942, as set forth in the Secretary of Agriculture's program, show dramatically the almost negligible contribution expected from the Central Hardwoods Region. Of a total of 33.8 billion feet, a half billion is anticipated from all this vast territory; less than one and a half percent of the nation's lumber from near ten percent of the commercial forest area. On a conservative basis of stocking and yield, the 45 million acres of woodland and forest included within the territory of this Station's responsibility ought to produce more nearly 5 billion feet of lumber and a huge volume of subsidiary materials.

The factors that have created this wide discrepancy between potentiality and actuality of yield have been enumerated often. They are over-cutting, fire, and grazing in existing forests, and ill-advised clearing for other uses, followed by the slow processes of forest regeneration on abandoned agricultural land. The main results of this general process of land exploitation are poor people, poor land, poor forests, and a continuing cycle of land mining for subsistence on a demanding scale.

There are processes at work that are aimed directly at the breaking of this vicious cycle and the restoration of the productive capacity of forests in the support of people. These processes are slow; they are hampered by immense sociological problems of populations whose ingrained habits of thought and action are completely at variance with the necessities of conservative land management. Public policies can go little faster than the thought of the people will permit and must often sacrifice progress toward set goals in order to take care of immediately pressing problems of



present populations. In times of financial stress, these are problems of relief and of unemployment. The exploitation of already ruined forests and land is accelerated because men must live. In times of prosperity, the temptation to gain income from any marketable material is too great to be sidetracked for a future gain through conservative management. The net result, as far as the forests are concerned, is that they are generally exploited in both good times and bad.

Land-use planning indicates the status of local thinking as to how land ought to be used, but it generally falls far short of suggesting how land use can be reorganized according to the plan. Generally the problems of population, ownership adjustment, and the costs of carrying land through the rehabilitation period while maintaining population, are staggering. Yet, they must be solved.

In the Station's territory, 1941 marked the development of forestry plans in Ohio, Kentucky and Missouri. While admittedly imperfect, all these do represent an awakening interest among the States themselves in their rough land problems. There is still an appalling lack of financial support for State programs in forestry. Clear recognition of the actual situations in submarginal agricultural lands is still limited to a few responsible Federal and State agencies. It cannot be claimed that there is strong and widely spread political support for these programs in any State.

Thus, the opportunity for constructive action in the rough, poor sections offered by the improved conditions due to defense and now, war efforts, may be lost. Population pressure on poor land is less during prosperous times. Greatly accelerated public purchase programs and



adjustments in population could be accomplished most advantageously during such periods. The base within public control thus established would provide a certain mechanism for socially profitable operations in the rehabilitation of land and forests during waves of depression.

But, there is no generally accepted land policy; it is in process of formation. The already grossly inadequate public funds applied to doing the various jobs involved will probably be further curtailed during the war because of vastly increased military expenditures.

Therefore, the unsolved problems in land and people may remain unsolved. The postwar period will bring the flocking back of poor people to poor land; the old problems will again become acute, only they will be more acute because the land and the forests will be poorer than in 1930--1935; another lower turn in the descending spiral.

Research in forestry, poorly financed through all its life in this region, made some gains during the late 30's due to availability of various emergency funds. Facing now the task of being prepared for a long war and a certain grimly real period of stress following the war, research has less resources than last year, and will probably have still less next year.

Can land policies be formulated on a basis of guesses? They have been and they will be unless more sure knowledge is obtained by research. War or peace, overcutting and the conflict in land use between grazing and timber continue in the Ozarks and elsewhere, to the undoubted detriment of people and the certain further impoverishment of the resource base. Public policies aimed at permanent solutions of the problems posed, cannot be intelligently framed on a basis of present factual knowledge. Such factual



knowledge will not be available when the next period of relief and public works rolls around. Methods of using public works for the reestablishment of economic bases have not been worked out. There are no real bases for land-use classification or for population patterns on rough land. There is trouble ahead, far greater trouble than 1933, in the hill country, unless a base is laid soon for action programs in the postwar period.

There are some phases in which progress during the past few years has been marked and in which distinct contributions toward guiding action programs have been made. For example, planting programs can go forward on a basis of rather good knowledge of sites, species, planting methods and nursery practices, all growing out of research results obtained in the past few years.

Considerable progress has been made in developing techniques of conversion of inferior stands in the Ozarks by underplanting and release. Much better silvicultural guides to stand improvement practices are available than were used during the late period of extensive CCC activities.

But, the general and very important problems of utilization of low-grade hardwoods are unsolved especially in their economic aspects. They must be solved if forests on private and public lands are to be brought into productive condition. Costs and returns, the public investments required, and the possibilities of realizing on labor opportunities for social gains in the rehabilitation process, must all be made known. Forms of organization, economic and social, for the accomplishment of these ends, ought to be tried out on an experimental basis. The basic methods of management of forests, silvicultural and economic, for maximum social results ought to be developed.



It is fairly apparent that a principal obstacle to good woods management in much of the Gern Belt and in the hill country lies in lack of utilization and marketing opportunities. A start has been made in examining conditions as they are, but the greater task of working out forms of successful economic organization to remedy the situation has not been touched.

This Station cannot even begin to discharge its responsibilities to Soil Conservation Districts, to Morris-Doxey Farm Forestry projects, to State Forestry organizations, to the National Forests, and to private owners of forests, in furnishing the factual data upon which their own action programs ought to be conducted.

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The year of 1941 was generally one of cleaning up many jobs, writing papers, and reorganizing program. Curtailed travel money, resulting from the practical cessation of all CCC and Flood Control contributions to Station finance, caused drastic reductions in field work which will undoubtedly continue for some time. Therefore, the demands of war permitting, the program for 1942 will include the pushing to virtual completion of the accumulated results of past work, the continuation and probable completion of the regional problem analysis, and the first formally organized work on the general project of site analysis and classification. It is expected that, by the middle of 1942, the financial status and organization of the Station will be sufficiently clear to warrant moving forward on a stable but curtailed scale.



As a part of the basis for a sounder future program:

- (1) The establishment of the Kaskaskia Experimental Forest in Southern Illinois was completed.
- (2) The famous "Cox Woods" in southern Indiana, a rare virgin tract, became a part of the Hoosier National Forest, and a permanent laboratory in Ecology.
- (3) Preliminary surveys looking toward the creation of a 5,000 acre experimental forest for permanent management in southern Indiana were made.

The services of Forest Service in this work provide the opportunity and training of numerous workers within experimental laboratory for survey purposes. Qualification of local workers suitable for more intensive use by individual workers was established.

An international and interagency conference on forest development methods believed to be applicable to the larger problems of forest management for the National Forests Region. These methods are being employed by the State Forestry Survey and the results will be closely watched for broader applicability.

#### State Forestry

Foresters in Department of Natural Resources in Indiana, Ohio, and Illinois are not systematically and periodically for future handling of such data made by on-the-ground research and study.

#### State Forestry

The progress has grown steadily in connection with these projects have not been met by specific area studies. It is believed that broader studies by forest and soil types can be of greater use and represent a more justifiable expenditure of effort. Specific services in management in projects cannot be given except through the medium of station publications.



## COOPERATION

The Station is inadequately prepared in personnel and financial resources to render all the cooperative services justifiably asked of it by State and Federal agencies. Within its ability and in accord with a policy of reasonable balance, it has rendered a considerable volume of aid to several enterprises in 1941.

### Ohio Woodland Survey.

During the year the services of Girard in Ohio made possible the preparation and issuing of numerous volume tables considered adequate for Survey purposes. Publication of local tables suitable for more intensive use by individual owners was continued.

An interregional and interagency conference on growth developed methods believed to be applicable to the complex problems of growth estimates for the Central Hardwoods Region. These methods are being employed by the Ohio Woodland Survey and the results will be closely watched for broader applicability.

### State Nurseries

Problems in treatment of nursery soils in Indiana, Ohio, and Illinois were met successfully and prescriptions for future handling of such soils made by on-the-ground analyses and study.

### S.C.S. Farm Forestry

The requests for growth studies in connection with these projects have not been met by specific area studies. It is believed that broader studies by forest and soil types can be of greater use and represent a more justifiable expenditure of effort. Specific services in management to projects cannot be given except through the medium of Station publications.



#### A. C. P. -- Ross County, Ohio

Attention has been given to the progress of the plan initiated in Ross County which involves intensive training of A. C. P. committeemen for the purpose of handling the woods management phases of the A. C. P. The County Agricultural Agent of Ross County reports 137 cooperators, exceeding the sum total of all other counties in the state. A field check of results on individual woods is planned for 1948 by the cooperating agencies. Neighboring counties are starting operations under the plan.

It is obviously beyond the powers of the Station to carry the Ross County plan to very many areas. It was hoped and expected that the Extension Service would carry on the program. One extension forester per State is, however, utterly inadequate, and unless far greater efforts in education of committeemen in practical woods management are forthcoming, no startling results can be expected from benefit payments for woodland improvement and protection. Nearly 8,000 copies of "Woodland Management" have been distributed by the Ohio Extension Service.

#### Spoil Bank -- Strip Coal Mining

In Illinois, Station personnel has given advice to State agencies and private concerns in regard to the proper treatment of spoil banks resulting from strip coal mining operations. Similar services have been given from time to time especially in Ohio and Indiana. The problem is not large in acreage or economic importance but the public importance is very large because of esthetic considerations.

#### F. S. A. Programs

Assistance has been given F. S. A. in the formulation of a five-county area program in southeastern Ohio. Important considerations in this program will be: (1) Land classification; (2) Forest resource







## FOREST MANAGEMENT

### General Review

The greater part of forest management research in this region in the immediate future should be concerned with problems in stand restoration, with adequate emphasis on methods of maintaining the productive capacity of the comparatively few high-quality stands.

At present, areas submarginal for farming fall into four general classes on the basis of cover: (1) Abandoned farmed or badly understocked cutover lands which will require planting, (2) cull stands, low in quality, and stands of inferior species in which emphasis must be placed upon removal and utilization of low-grade material to favor improvement of the residual stand and natural regeneration, (3) fully stocked second-growth stands of good composition (judged from the present conception of adequate stocking) in which silvicultural methods will be directed toward their maintenance and toward attainment of maximum growth, and (4) essentially virgin stands in which emphasis will be placed on aiding residual growing stock and reproduction by removal of mature trees and in which studies of site factors in stabilized stands may be conducted. Second-growth stands of good quality and composition, although relatively limited in extent, are frequent and extensive enough to supply adequate experimental areas on which to test hypotheses in management research. Too few virgin or stabilized stands, available for experimental use, exist to warrant consideration of cutting-method studies at this time. However, these stands will serve as areas for basic studies of ecology.

Two rather broad forest formations, the hardwoods generally of the Ohio Valley and the hardwood-pine of the Ozarks and similar areas in Kentucky and Tennessee will have to be reckoned with separately in many



studies. In restoring the hardwood stands to desired composition and stocking, pine species will play important roles in developmental stages and will be retained on limited areas as components of the managed forests. Where the pines were commercial constituents of the original forests and commercially the more important in the secondary stands, somewhat different practices will undoubtedly have to be followed in maintaining the optimum mixture of species whose tolerances to sites are quite different.

No one of the phases of the regeneration problem, seed, nursery, and planting investigations, is more important than any other. Immediate needs, however, have dictated that greater emphasis be placed upon quality of nursery stock classes and the relative responses of these classes under varied field conditions during the period of establishment. More urgent of the seed problems have been dealt with as need for their solutions arose.

Of first concern among the areas classified for reforestation was the great amount of land, eroding and contributing to excessive runoff, whose soils had deteriorated to a degree incapable of supporting growth of the original hardwoods, a fact established in early planting tests. Because of the general failures of hardwoods on such lands, attention has been chiefly directed toward indigenous pines, especially with respect to influence of soil treatments on nursery stock, to survival and early growth of age classes in old fields and cull stands and their relative responses to conditions of soil, to evaluation of stock grades in field planting, and to effects of stock treatment and of planting methods upon survival and growth response. With the exception of minor problems in these phases of work, the Station has advanced its pine cover establishment program sufficiently to meet most of the urgent needs.



Beyond the period of establishment, the aim is two-fold; (1) to evaluate site changes, particularly in soil and subordinate ground cover, effected by the planted cover and to correlate them with the rehabilitation of the area and with natural hardwood reproduction and (2) to develop plantation management practices, some of which are under test, which will insure maximum returns of usable products without hazarding the primary purpose for which the plantations were made.

Establishment of hardwood species with assurance of satisfactory subsequent growth represents a far more difficult problem than that for pine and now one of growing concern. Although some progress has been made in plantings in the better soils, the bulk of the work is ahead. Greater attention than for the pines will be required in site classification based upon specific requirements of the species. Investigations dealing with soil factors and with the influence of protective cover will be important.

Silvicultural problems in the Central States region are, in the main, those of (1) restoring to something of its original productivity a forest resource that has been depleted and (2) maintaining well-stocked stands of good composition. Overcutting and high grading have resulted in many understocked stands containing a high percentage of defective trees and of trees of inferior species. Frequent burning and sometimes heavy grazing have stagnated reproduction and growth by direct injury and indirectly by soil deterioration. Land unsuitable for cultivation has been cleared, and some of it farmed a few years and abandoned because of low returns. The extent to which all these factors have been responsible for forest degradation has not been the same in all parts of the Central States region, or even in all parts of the same stand.



Granting adequate protection, without which a forest rehabilitation program cannot be expected to succeed, the following general points for silvicultural research should be stressed: (1) Condition and potentialities of trees in the present forest cover and the silvical and ecological characteristics of the important tree species, (2) conditions and potentialities of the soil from the standpoint of quantity and quality of forest products it can produce, (3) forest type and stocking best suited to the different sites from silvical and economic standpoints, (4) extent to which natural processes may be depended upon to bring about desired changes in the forest cover and time required, (5) silvicultural practices necessary to bring about or hasten desired changes, (6) methods of harvesting to maintain or perpetuate the well-stocked stands having good composition.

An appraisal of both merchantable- and unmerchantable-size trees in the present stands will facilitate present and future utilization and management practices. A better understanding of the amount and quality of sound wood in the merchantable sized trees, most of which are defective remnants of the old-growth stands, is needed. The sapling- and pole-sized trees, which constitute a considerable part of the overstory in many of the present stands, are largely of sprout origin. Many are fire scarred, and practically all contain numerous knots and stubs. The extent of these defects and the extent to which quality of new wood produced on these trees will be lowered by such defects should be determined.

Soil and other site factors have been rendered less favorable for tree growth in varying degree by highly diversified cutting and land use practices. This situation requires the development of a basis for site evaluation. Soil characteristics must be studied in relation to present



forests in all their stages of degradation from the virgin forest down, and to the forests which have reached their maximum productive capacity. These relations should provide a basis for prediction of recovery rate under protection.

In most of the stands natural regeneration, particularly seedling, is not developing at a satisfactory rate. The reproduction is predominately of sprout origin, relatively slow growing, generally poor in form, and has a high percentage of trees of inferior species. It is essential to evaluate it in terms of its capacity to produce a crop during a reasonable rotation period. Although there is considerable evidence that seedling regeneration is improving with protection, available information on factors affecting production and germination of seed, and establishment and growth of seedlings of different species does not permit prediction of future stand composition and quality. Knowledge of the anatomy and physiology of sprouts and factors affecting sprout development are necessary to regulate sprouting. To what extent composition and density of reproduction may be controlled is still problematical.

Feasibility of pruning to produce high-grade products should be determined. Before pruning is undertaken on a large scale, facts should be learned about (1) the size of trees that should be pruned and (2) the effects of removing different amounts of the live crown on the growth rate of the trees and on the development of sprouts on the pruned stem.

Methods of harvesting to be applied to merchantable second-growth stands are needed now and will be needed more in the future. They should insure adequate development of the desirable larger reproduction where it exists, stimulate adequate restocking of desirable species in stands lacking in reproduction, and create favorable conditions for growth of residual stand.



In mensuration, current stress is laid upon construction of volume tables, upon growth in natural stands, and upon both growth and yield in planted stands. The greatest demand for volume tables has resulted from the inventory of Ohio Woodlands by the Ohio Forest Survey group in cooperation with this Station. The tables have facilitated more accurate appraisal of the present content of stands. Volume table services have been requested by and granted to the National Forests for facilitating purchases and sales. Conversion of wood volume from one unit measure to another will become increasingly prominent and require attention as a closer and more diversified utilization is practiced. In view of the present rather poor quality of a high percentage of forest stands throughout the region, growth studies will serve as a basis for short-period predictions of yield. After protection and stand improvement measures have resulted in stand rehabilitation, as undoubtedly they will in a reasonable time, greater necessity will arise for yield studies, basic to longer time predictions and ultimate management plans. Occasional stands of limited area now lend themselves to initial yield studies, and advantage will be taken of such stands to satisfy increasing queries by private forest land owners concerning values of their holdings. Inspection of growth in present stands will serve as one of the chief criteria in site evaluation studies of immediate assistance in forest land classification.

Although emphasis has been laid on adaptation of experimental design and sampling in some phases of management research, there is much to be accomplished in methods and particularly in sampling of the natural, highly variable stands for more effective research.



## Accomplishments in 1941

In this section is reported only work completed in 1941, and work representing progress in incomplete studies.

### Regeneration

Direct Seeding of Indigenous Pines. Direct seeding studies in old fields, conducted during the last six years, have been concluded with results indicating lower costs for establishment of tree covers on land to be reclaimed. Cost of seed ranges from \$ .50 to \$ .75 per acre for 6' x 6' spacing of spots each with 5 good seed, estimated. To this may be added the cost of about one and one-half man days, totaling \$3.50 to \$5.00 per acre, depending upon current labor costs, in contrast to \$10 to \$15 per acre for planting. With the exception of narrow ridge tops and upper exposed slopes, old fields with protective covers of bunch grasses or herbs have supported catches on 50 to 95 percent of the spots seeded, or about 600 to 1100 spots per acre with 1 or more trees each. This year's concluding series of fall and spring spotted seed has indicated no appreciable difference in germination; but of those seed germinating, 91 percent of those in fall spots survived as against 81 percent of those in spring spots. The respective survivals for seasons, fall and spring, bear close relation to those for stratified and dry seed previously spotted in spring. In effect fall seeding and stratification of seed for spring seeding are quite comparable for survival.

Seed spotting of shortleaf pine in forest stands in the Missouri Ozarks, if accompanied by removal of most or all of the overstory trees, appears equally as promising as direct seeding in old fields.



Shortleaf Pine in Conversion Planting. In the Missouri Ozarks, interplanting and underplanting of cull oak stands and of denser stands of inferior species with subsequent release of planted stock seem to be feasible methods of rapid conversion to more productive forests. Planting results of four watered classes of 1 - 0 seedlings, three pruned classes of 2 - 0 seedlings, and 1 - 1 transplants of shortleaf pine were evaluated on the basis of seasons, of open and closed stands, and of two districts of the Clark National Forest. The following inferences have been drawn: (1) Planting should be done in the spring rather than in the fall to the full extent that is practical from the administrative point of view. (2) Difference in survival and growth, indicative of differences in stock vigor, are greater among lots of different classes of stock planted in the fall than among lots of the same classes planted in the spring. Accordingly, in any planting done in the fall the best of planting stock should be used. (3) All age classes of planting stock exhibited greater growth in response to open than to closed stands. (4) One-year seedlings developed in nursery beds with no artificial watering do not survive in field plantings so well as those watered. (5) Survival and growth capacities of 2 - 0 seedlings can be improved by top and root pruning in midseason in the nursery. (6) In consideration of economy of production and field behavior, a high grade of 1 - 0 seedlings is unquestionably preferable to any grade of any other age class for general use. Where exceptionally severe competition from existing ground cover must be met, 1 - 1 transplants are more desirable.

Stock Grades in Field Planting. In three years of field testing of all available grades of 1 - 0 shortleaf pine seedlings based on



combinations of caliper (in 1/20-inch units) at root crown and of height (in 4-inch units) produced in the Valleria, Licking, and Oak Forest Service nurseries, definite correlations of stock grade with survival and height increment have been noted. Consistent best performance through the three years of nursery crops and of seasonal variations, has been associated with 3/20- to 4/20-inch caliper and 8- to 12-inch height, the poorest performance being correlated with the tall spindling seedlings. Closer correlation of survival and growth was obtained with caliper than with height. These results have given a better basis for effective grading at the nursery and a better notion of a standard to work toward in nursery production than have previously been available.

Underplanting with Hardwoods. Since experience has indicated general failure of hardwood plantings in old fields, underplanting of planted pine and black locust and natural sassafras growth in old fields with relatively shade-tolerant species in Ohio and Illinois has been tested and found to be a likely method of hardwood establishment, a tool to hasten compositional change where intensive management may be justifiable.

The protective cover value of stands of pine, black locust, and sassafras has been demonstrated by the better survival of black cherry, yellow poplar, northern red oak, white oak, and white ash under them than that of the same species in old fields. Green ash did not survive differently. All species responded in height increment best to black locust cover and poorest to old field cover. As a cover, black locust undoubtedly excels because of the more adequate supply of nitrogen in its soil. Modification of air and soil factors other than fertility about the planted seedlings under the tree covers seems to be chiefly responsible for the better establishment.



### Black Locust Seedlings from 14 Seed Sources Show No Growth

Differences in Field Plantings. Six years after planting to find a silvically good "strain," resistant to locust borer, black locust from 14 stock sources plots have been examined for those differences in growth characteristics considered important to usable products. All the sources of seed were some of the best planted and natural stands well distributed in eastern United States. No records of source or adequate descriptions of some of the planted parent trees are available; but whatever economic growth differences there may have been in the parent trees are not evidenced by the analyzed height and diameter growth data from the test series and were seemingly non-heritable ones. The dominant trees, now approximately twenty feet in height, do not show any appreciable variation in stem form. All sources have responded essentially alike to each one of the several site qualities on the area. The chief value which may be salvaged from these test plantings, to be maintained for observation, is a precaution against prematurely assessing hereditary causes for differences not adequately investigated.

### Silviculture

Reproduction in Oak-Hickory Stands in Missouri Ozarks. Natural regeneration in the oak-hickory forest stands in the Missouri Ozarks has been greatly disrupted during the last half century by improper harvesting methods, overgrazing and frequent burning. A study of reproduction in 1938 showed that it averaged 4 years in age and 21 inches in height and, in general, had poor form. About 78 percent of the individuals were stool sprouts, sprouts with enlarged calluslike structures at the ground line caused by repeated killing of the tops and subsequent sprouting. The



percentage of these sprouts was less in the reproduction that originated since the beginning of an effective protection program. On the basis of an examination of large trees of similar origin it is believed that the decay hazard of stool sprouts will be negligible. No evidence of stunted growth or of mechanical weakness at the base of the stem was found in these larger trees.

No evidence that height growth was materially affected by age and composition of overstory and exposure, appeared. Although a high percentage of the reproduction was of less desired species in over 80 percent of the stands, the stocking of the better species averaged 500 or more. Because of higher growth rate and lower mortality, trees of these more desired species are not very likely to be eliminated from the stands by competition from similar trees of other species.

Response of Reproduction to Release. In the Missouri Ozarks the height growth rate of underplanted shortleaf pine in areas given a heavy overhead release at time of planting or soon thereafter is sufficiently great to make subsequent releases unnecessary. This is especially true if release is accomplished by shallow girdling which reduces the number and size of sprouts that develop. Because of this faster growth of released shortleaf pine transplants and of the relatively greater height growth of sprouts from cut-back hardwood reproduction than that which has not been cut, releases in the understory should be limited to those instances where the pine is definitely overtopped by hardwood reproduction.

Relative Growth Rates in Hardwood, Hardwood-Pine, and Pine Types. The growth rates in trees over 9.5 inches in d.b.h. for three principal forest types on the Sylamore Experimental Forest, ranging in age from



40 to over 160 years, were determined from records over the 5-year period ending in 1939. The periodic mean annual growth in the shortleaf pine-hardwood, shortleaf pine, and white oak-black oak-hickory types was 269, 183, and 144 board feet per acre, respectively. This relation exists in all age classes from 40 to 160 years. No appreciable differences in site indices, based on mean heights of dominant and codominant trees, were detected. These findings will be of importance in practices aimed at maintaining proper composition.

Measuring Small Changes in Tree Diameter. An improved, inexpensive, dendrometer with a vernier makes possible studies, in which it is necessary to measure tree responses in terms of small changes in diameter, which have heretofore been impractical because of the high cost of dendrographs. Several of the dendrometers were placed on each of several trees to check their consistency in measuring diameter changes throughout the growing season. Also, 6 of them were checked against 2 dendrographs. They were found to be a satisfactory means of detecting and measuring changes in tree diameter as small as 0.003 of an inch.

Harvesting Low-grade Oak in Northern Arkansas. A study of harvesting and utilizing low-grade hardwoods in mixed hardwood-pine stands on the Bismore Experimental Forest in Arkansas demonstrated the difficulty of predicting the quantity and quality of products that can be saved from such trees; also that if the operator is to make a reasonable profit, a sufficiently large amount of the good growing stock has to be removed so that the stand is not improved silviculturally by the cut.

This first study will be followed by others in other parts of the region when possible. Such knowledge is basic to management.



## Measurement

Better Volume Tables for Ohio Woodlands. Construction of volume tables and checking their applicability in different parts of the state have greatly facilitated and made more exact the work of the Ohio Forest Survey. The number of tables required to provide mean net contents of trees in board feet and in cubic feet, rough wood, outside bark has been minimized by basing tables on form class thereby permitting the bracketing of volumes of several species by a single volume table.

A reworking of the data into tables reading in d.b.h. and merchantable length in 12-foot logs has been completed. The International log rule, 1/4" bark, was the basis for compilation. These tables are the first of their kind for Ohio and represent a more usable tool in the hands of private woodland owners.

By-products of the Volume Table Work in Ohio. The Ohio Forest Survey recognizes the open, grazed, sod-bearing woods as the poorest class (Class III) of Ohio woodlands. The mean tree volume in this class of stand is lower than that for the two better classes (I and II), holding for all species except red oak, beech, red and silver maples, white ash, and basswood. Mean volume for most species in the Class III woods of western Ohio is lower than that for the same class in eastern Ohio, attributable in part to the more moderate relief and variable climate and in part to a greater predominance of grazed areas in the western portion. Log grading of standing trees revealed a higher quality of timber in eastern than in western Ohio.

Estimating Taper Value for Section of Stem. In a study of the effects of pruning in a young plantation of shortleaf pine, a method, simple in application, was developed to provide a quantitative measure of taper. The taper value in inches per foot for a section of tree stem is simply the



difference between the two basal diameters in inches divided by double the length of section, in feet.

#### Work Planned for 1942

##### Forest Management

In 1942 emphasis will be placed upon maintaining work now in progress and upon reporting results of completed studies rather than upon initiation of new experiments, necessary changes in program being anticipated whenever defense duties arise.

##### New Work

1. Priority will be given to analysis of the forest management problems of the region.

2. Site evaluation studies will begin, to serve as a basis for forest land classification.

3. Studies designed for growth and yield in a mixed, many-aged hardwood stand in southern Indiana, will be established.

##### Current Work

1. Complete manuscripts on (1) structure and composition of black locust seed coat and (2) results of five years of direct seeding of indigenous pines in old fields. Prepare reports on (1) underplanting of different planted and natural growth covers with hardwoods and (2) stock grades of shortleaf pine best adapted for old field planting. Initiate work on manuscript dealing with planting of shortleaf pine in the Central States. Continue work in direct seeding under decadent Missouri stands. Routine observations will be made on all going planting studies.

2. In silviculture, manuscripts on (1) harvesting and utilizing shortleaf pine and low-grade hardwoods in Arkansas, (2) ten-year growth



and mortality in selectively cut upland hardwood stand in Indiana, (3) origin and development of dormant buds in oaks, (4) effects of seed-bed treatment and release on establishment and growth of shortleaf pine seedlings, (5) effects of different types and amounts of release on survival and growth of pine transplants in the Missouri Ozarks, (6) results of studies since 1929, on relation of soil characteristics to forest growth, and (7) shortleaf pine seedling response to differential fertilizing in nursery soils will be published or offered for publication. Examine and report results to date of effects of thinning and release on residual stands on Sylamore Experimental area.

Continue field work on condition and potentialities of saplings and poles in forest stands of the Missouri Ozarks. Periodic diameter and height measurements, during growing season, of oak and pine saplings and poles in Missouri stands will be made for correlation of increment with stage of tree development, a continuation of the similar study on reproduction. Extend the pruning studies in planted pitch and shortleaf pines to estimate effects on growth rate, stem form, and wood quality.

5. Results from mensurational studies will be reported in (1) volume tables for use in reconnaissance of Ohio woods, (2) factors to apply to Missouri white oak for converting from either board foot estimate or stave and header belt estimate to the other, (3) growth and yield of planted black locust, (4) relative growth and yield in merchantable volume from stands of hardwoods, pine, and mixed oak and pine on the Sylamore Experimental Forest.



## FOREST ECONOMICS

### SURVEY OF FARM WOODLAND CONDITIONS IN ILLINOIS AND OHIO

#### Introduction

A desirable goal for forestry on farms in the Central States region would consist of the orderly production of forest raw material in the present woodlands, the supplying of the basic farm needs of fuel, fence posts, a considerable share of lumber for building repair and replacement, and the marketing of a portion of the higher-grade material to locally-operated industrial plants. Utilization of material produced in farm woodlands may be much more nearly complete than in industrial holdings of comparable growing stock because the bulk of farm needs may be met by products fashioned from low-grade material. In the ideal set-up, the farm woodland should be large enough to supply home needs from the discarded material remaining after sales of sawlogs or like products, and from thinnings and other cuttings directed toward improvement of the woodland growing stock.

The realization of this goal requires growing stock ample in quantity and quality to supply light and frequent cuts of industrial material because farm needs, particularly for fuel, must be met currently. Likewise the market outlets must be stable in character to give faith in the future to the woodland owner, otherwise cuts impairing or wrecking woodland productivity may be the pattern of sales.

To determine for representative areas in this Station's territory the extent to which woodlands, farm needs, farm operators' attitudes, and commercial processing plants measured up to the task of facilitating such production and marketing was the first job undertaken in forest economics.



### Work Prior to 1941

The first field work done in this project dealt with 751 acres of farm woodlands located in northwestern Ohio on level or gently sloping topography. The work was done in the spring of 1938. In many, though by no means all, of the woodlands, heavy cuttings in the past had reduced forest growing stock to a low point though usually timber of pole size was present in quantities to augment future stands. In one of the localities, where the farm population was largely of German extraction, more than one-half of the woodland area examined bore a saw-timber growing stock of over 9 M board feet per acre and the gross annual growth in trees of saw-timber size was more than 200 board feet per acre.

Certainly not by chance, the local community contained a small efficient woodworking plant utilizing about 3 M board feet per day of sawlogs. The sawmill of this plant was available for local sawing on a custom basis. It also sawed out material for farm structures from its own log supply. A yard stocking softwood lumber and creosoted posts was maintained for local trade. These activities were sidelines for its major work, the fabrication of millwork, furniture, wheelbarrows, beekeeper's supplies, churn paddles and the like. Probably less than one-half the raw material used in the plant was sawed in the mill. A large quantity of southern hardwood lumber was purchased.

Of particular interest from the standpoint of continued woodland productivity was the plant's practice with some owners, at least, of buying timber at intervals of 2 or 3 years from the same woodlands. In one of these cases the woodlands were parts of tenant-operated farms but the landlord, a local man, retained the woodland management. The felled material,



remaining after log sales were made, provided the basis for fuel-wood and fence post production.

Under a combination of woodlands and commercial plants such as described farm forestry makes a big contribution to farm and community income.

Throughout the area studied market outlets were fair and good prices were paid for stumpage and sawlogs. Among the more common hardwoods, basswood was in demand while white ash and walnut ranged high in price.

For the most part, even on farms where woodland growing stock was badly depleted, the owner's viewpoint was that the woodland was a definite asset to the farm and he declared his intention to retain it in the future. So far as farm needs were concerned a part or all of the fuel supply was furnished by the woodland. Usually fence posts were purchased.

During 1939 another study was made on a series of randomly chosen farms in 4 counties of northern Illinois under a cooperative agreement with the State Agricultural Experiment Station. In this study attention was directed toward farm buildings and pasture resources as well as toward woodlands and the use of forest products.

Late in 1939 work was begun on compilation and analysis of the data obtained. The major part of the analysis of woodland data was done in 1940 with clerical assistance from the Forest Measurements Section of the Washington Office under supervision of E. B. Day.

#### Work in 1941

Early in 1941 many of the numerous tables developed for the woodland phase of the Illinois study were rearranged after preliminary editing, the subsection on farm uses of forest products, purchases, and sales was



prepared, and the first draft of the manuscript embodying these forest findings was submitted to the State Agricultural Experiment Station. The text and tables were mimeographed by that agency under the cooperative agreement.

During 6 weeks in midsummer tables were compiled, again in the Washington Office, dealing with the pasture and building phases. The first drafts of manuscripts on these phases are practically complete.

A brief review of some of the more significant findings of the Illinois study is made here.

Although topography had little bearing on woodland location among the farms examined in northwestern Ohio, it had a great deal to do with woodland location in the deeply-dissected districts in northern Illinois. Forestry appeared to offer the only permanent use of land on steep slopes in these areas. An alternative, in some cases, might be pasture use carefully controlled to avoid excessive erosion.

Woodland inventories and growth predictions disclosed growing stock much lower in quantity and quality than in northwestern Ohio. Annual growth rates were little more than half. The so-called "good" trees (those sought for commercial utilization) were the basis of the inventory and growth predictions. Sound and rotten cull trees were tallied, however. In some saw-timber stands the proportion of these sound culls ranged up to 75 percent of good tree volumes. Though saw-timber growing stock was low, the stocking in the pole sizes indicated, in general, that present volumes would be matched or increased in the future.

Other than small sawmills, sometimes adjuncts to farms and operating mostly for the local trade, commercial activity in products sawn from forest raw materials was comparatively rare. There were practically no



sales of stumpage or sawlogs reported for the previous year from woodlands. Current stumpage prices, if movement of raw material were adjudged sufficient to establish them, were low, probably half of those found in northwestern Ohio.

The use of home-grown forest products on Illinois woodland farms was comparatively large. For all the localities the 1938 cut of fuelwood averaged slightly over 7 cords on 40 farms of 60-179 acres in size and about  $7\frac{1}{2}$  cords for 40 farms of 180 acres or more. In each case coal used during that year was about  $1\frac{1}{2}$  tons per farm. Numbers of fence posts cut for home use in the same year averaged 93 and 84 respectively and were supplemented by purchases of 10 and 28.

With current prices for fuelwood at \$4 per cord and for local fence posts at 25 cents each, the presence of forest raw material and expenditure of farm labor in the conversion to fuel and posts saved an outlay of about \$51 in 1938 for the average small and large farm alike. Lumber cut from farm woodlands in 1938 was mostly confined to a few cases where sawmills were parts of the farm business. As an average of 40 small farms about 2,050 board feet were cut and 1,350 board feet were sold, usually in the local trade. If \$30 per M board feet be taken as the market value and \$10 per M board feet be considered costs incident to logging and milling, about \$41 per farm was gained by the lumber production, \$27 of which was in cash. The 40 woodland farms, 180 acres and larger in size, averaged 350 board feet cut in custom mills in 1938 and 150 board feet bought.

The average size of woodland on the small farms was 26 acres. Nearly 47 acres in a like state of productivity would be required to care for annual cuts at the 1938 rate from saw-timber growth. The growth figures



take account only of good trees. Fuelwood supply for years to come could be furnished by sound cull trees in many of the woodlands. Likewise it is assumed that cuts for farm use came from commercially desirable trees of saw-timber size rather than from trees of pole size or culls.

On the large farms the average woodland size was 45 acres and the 1938 cut could be supplied from the estimated saw-timber growth on 37 acres. It is evident that few of the farms could be expected to offer much raw material for sale, while supplying current farm needs, without directing home use toward the cull timber. It is upon woodlands larger or higher in yield than the average that commercial utilization would have to be based.

It is clear that overcutting was more severe on the smaller farms.

#### Pastures on the Illinois sample farms

One of the most obvious and frequently mentioned characteristics of Corn Belt woodlands is the practice of livestock grazing. Inasmuch as woodland grazing is widespread it seemed desirable to make some estimates of its contribution to livestock support on individual farms in the Illinois study compared to the forage available from other pasture areas. A system of secular estimate in pounds of steer gain per acre for the grazing season, with pastures of known productivity as a base, was formulated with the aid of the Department of Agronomy, University of Illinois, and applied during July and August 1939 by the graduate agriculturists hired for the study.

For 62 woodland farms in the Illinois study there was an average of 80 acres regularly used for pasture, 40 percent of this was woodland. It was estimated that about 22 percent of the forage available for grazing was produced in the woodlands. From the standpoint of utilization of forage 28 percent of the woodland area was classed as undergrazed, 71 percent as moderately-grazed, and less than 1 percent as overgrazed.



On the basis of productivity estimates, comparisons may be made between classes of pasture examined. Because of limitations imposed by topography, nonplowable permanent pasture presents the alternative use most nearly applicable to woodland areas. It is estimated that from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  acres of woodland would be required to supply the same amount of cattle gain as an acre of nonplowable permanent pasture. Forage for grazing in woodlands of these localities was usually made possible by heavy cutting in the past. Good forage yield in woodlands, therefore, constitutes evidence of lowered forest productivity. Grazing operates as a factor tending to continue lowered forest productivity in those instances where regeneration is retarded by soil and by browsing. Through the range of woodland condition classes from heavier saw-timber stands to seedling and sapling stands in a given forest site-type association the rate of saw-timber growth declined from an average of 130 board feet per acre per year to a negligible amount. The estimated pasture gain available in the same classes did not show a trend upward or downward, but ranged in the neighborhood of 20 to 50 pounds of live weight per acre for the 1939 grazing season.

This lack of trend in forage production for the woodland classes is understandable as the best of these groups averaged but 4 M board feet per acre in good trees of saw-timber size, thereby allowing ample space for development of forage.

Was there evidence that grazing had retarded seedling establishment? As an average of all woodland condition classes throughout the study about 50 percent of the  $1/400$ -acre quadrats were stocked with one or more seedlings of good form. No general conclusions could be drawn

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for the woodlands as a whole with regard to pasturing as definitely associated with seedling distribution. One contributing factor may have been the classification of woodlands with grazing in 1939 as the criterion rather than a longer period. However, it is unlikely that the practice of grazing would vary from year to year. Most of the grazing encountered in 1939 was of an intensity which would not entail heavy browsing of seedlings due to scarcity of forage.

#### Buildings on Sample Farms in Illinois

The number and kind of farm buildings, the volume of building lumber in use, and the amount of lumber required to bring them to an acceptable state of repair were some of the objectives in the study of structures on the sample farms of Illinois study.

In general, farms from 60 to 179 acres in size had slightly less than 50 M board feet of lumber in buildings and 180-acre farms and larger had about 70 M board feet in use. Somewhat more than one-third of the lumber was in farm dwellings. It was estimated that about 6 percent of the lumber in buildings on the small farms and 5 percent on the large farms required replacement. Repairs during the previous year averaged about 1 percent of lumber in use.

#### Proposed Work in 1942

There is from a month to 6 weeks required to complete the text of the reports for the studies made in northern Illinois and northwestern Ohio. They are intended for publication, probably in combination, as a Department bulletin. Decision on this point will await review of the manuscripts. The major work remaining is preparation of the Ohio manuscript and write-up of case studies for the 2 jobs.



Since the Station has assumed responsibility for gathering 1941 lumber production and price information from the Central States in cooperation with the Bureau of the Census, some of the needed time for this job will have to be provided from this project.

Preliminary to or contemporaneously with the formulation of an analysis of the general economic problem of forestry in this Station's territory a study should be made of methods of purchasing raw material, processing, and selling forest products. The general features of such a study may now be stated; the specific details and procedures remain to be outlined. The location of such work would be in the unglaciated section of our territory, probably in contrasting areas; for example, 2 counties, one where commercial production is known to be active and the other where it is known to be relatively inactive.

The methods and expense involved in acquisition of the forest raw material, the amount and character of investment in processing machinery for different products and costs and output involved in its operation are essential points on the processing side. The methods, costs, and returns involved in sale either to the ultimate consumer for products like railroad ties or to the secondary processor in case of industrial lumber make up the other side. Transfer of specialty material such as that intended for handle stock, veneer or the like which is not usually fabricated by the small producer would also be scrutinized. Results from such a study, when properly coordinated and interpreted, should provide a better background for judgment on the efficiency of marketing, which in the long run is the basis for stumpage prices.



## OHIO STATE-WIDE FOREST SURVEY

In 1939, the Ohio Forest Survey was initiated with WPA funds and was sponsored by the Ohio Agricultural Experiment Station. Early cooperation between this Station and the Survey personnel involved analysis and compilation of the Survey's volume tables. The Survey functioned under its original status until April of 1941 when its sponsorship was assumed by the Forest Service with direct responsibility delegated to this Station. In September greater emphasis was placed on the growth phase, and as a result, a conference was held in Columbus of Nation-wide Survey personnel of the Washington Office, Lake States and Appalachian Stations with personnel of the Central States Station and the Ohio Survey. The chief point of concern was a method of obtaining adequate growth estimates on a county basis. James W. Girard, Assistant Director of the Nation-wide Survey, has greatly assisted in developing and standardizing the field procedure.

Generally the field work has been completed in a band extending across the State in a southwest-northeast direction and includes the following counties: Hamilton, Clermont, Highland, Clinton, Warren, Butler, Preble, Montgomery, Greene, Darke, Miami, Clark, Madison, Franklin, Mercer, Anglaise, Shelby, Logan, Licking, Coshocton, Knox, Holmes, Richland, Wayne, Stark, Columbiana, Huron, Lorain, Medina, Summit, Portage, and Cosauga. Those counties in which work is in progress are Brown, Adams, Scioto, Ross, Pickaway, Van Wert, Allen, Hancock, Lucas, Ashland, Muskingum, Belmont, Tuscarawas, and Ashtabula. Base maps from aerial photographs have been completed for the counties of Pike, Fayette, Guernsey, Harrison, and Jefferson. Thirty-five counties remain in which no work has been done. Reports have been issued for Butler, Preble, Miami, Shelby, Richland, Wayne, Medina, Lorain and Portage Counties. Reports for Madison and Anglaise Counties are ready for issuing in 1942.



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STATION RELEASES

Articles Published

1. Arend, John L. 1941. Infiltration rates of forest soils in the Missouri Ozarks as affected by woods burning and litter removal. *Jl. For.* Vol. 39, #8. ✓
2. Chapman, A. G. 1941. Tolerance of shortleaf pine seedlings for some variations in soluble calcium and H - ion concentration. *Plant Physio.* Vol. 16, #2, pp. 313 - 325. ✓
3. Cummings, William Hawke. 1941. Fertilizer trials for improved establishment of shortleaf pine, white ash, and yellow poplar plantings on adverse sites. *Jl. For.* Vol. 39, #11. ✓
4. \_\_\_\_\_. 1941. A method for sampling the foliage of a silver maple tree. *Jl. For.* Vol. 39, #4. ✓
5. Emmer, Robert E. 1941. A simple method of estimating taper. *Jl. For.* Vol. 39, #12. ✓
6. Hall, J. Alfred. 1941. Objectives in farm woods management in the central hardwood region. *Ames Forester*, Vol. XXIX, pp. 31 - 34. ✓
7. \_\_\_\_\_. 1941. Forests, land and people in Kentucky and Tennessee. First Annual Southern Chemurgic Conference, Nashville, Tenn., June 18, 1941, Mimeograph No. 104. ✓
8. Johnston, John P. 1941. Height-growth periods of oak and pine reproduction in the Missouri Ozarks. *Jl. For.* Vol. 39, #1. ✓
9. Kuenzel, John G. 1941. Tom Porter gets "over the hump." *Forest Service Bulletin*, Vol. 25, No. 17. ✓
10. Liming, Franklin G. 1941. Two new girdling saws. *Jl. For.* Vol. 39, #12. ✓



Reports Mimeographed

1. Auton, John T. 1941. Black locust, pines, and sassafras as builders of forest soil. Tech. Note #32. ✓
2. \_\_\_\_\_. 1941. Forest soil properties associated with continuous oak, old-field pine, and abandoned field cover in Vinton County, Ohio. Tech. Note #34. ✓
3. \_\_\_\_\_. 1941. Notes on old-growth forests in Ohio, Indiana, and Illinois. Tech. Note #49. ✓
4. Cummings, W. H. 1941. Effect of screen protection on first-season growth of yellow poplar planted in an old field. Tech. Note #28. ✓
5. Hall, J. Alfred. 1941. Objectives in farm woods management in the central hardwood region. Station Note #40. ✓
6. \_\_\_\_\_. 1941. Addresses: (1) The job of forestry research in the Central States, (2) What can be done to encourage use of Ohio-grown hardwoods, (3) An effective forestry program for Ohio, (4) Forestry research in the Central States, (5) Limitations and potentialities of forestry in southeastern Ohio, (6) Forests and farms in southeastern Ohio.
7. Kellogg, L. F. 1941. Log grade of timber in eastern Ohio: I. Eastern white pine on Mahican River Gorge, Holmes County, Ohio. Tech. Note #38. ✓
8. Volume tables: (Local volume tables) Yellow poplar, Holmes County Ohio, Tech. Note #24; eastern white pine, Holmes County, Ohio, Tech. Note #25; eastern hemlock, Holmes County, Ohio, Tech. Note #26; white oak, Franklin County, Ohio, Tech. Note #27; white oak, Holmes County, Ohio, Tech. Note #28; white ash,

✓      ✓      ✓      ✓      ✓  
24, 25, 26, 27, 29

✓  
28 (not above)



Franklin County, Ohio, Tech. Note #30; black walnut, Franklin County, Ohio, Tech. Note #31; northern red oak, Holmes County, Ohio, Tech. Note #33; (volume tables) eastern white pine, Mohican River Gorge, Holmes County, Ohio, Tech. Note #35; eastern hemlock, Holmes County, Ohio, Tech. Note #36; black gum, Holmes County, Ohio, Tech. Note #37; chestnut oak, Monroe, Maskingum, Pike, Ross, Washington Counties, Ohio, Tech. Note #39; red elm, Ross, Knox, Medina Counties, Ohio, Tech. Note #40; shagbark, pignut, bitternut, hickories, Pike, Ross, Monroe, Gallia, Coshocton, Medina, Richland, Holmes Counties, Ohio, Tech. Note #41; shortleaf pine, Jackson, Gallia Counties, Ohio, Tech. Note #42; pitch pine, Jackson, Hocking Counties, Ohio, Tech. Note #43; Virginia pine, Pike, Hocking Counties, Ohio, Tech. Note #44; beech, Franklin, Stark, Holmes Counties, Ohio, Tech. Note #45; sugar maple, Ashtabula, Geauga, Highland, Mahoning, Medina, Portage, Pike, Richland, Ross, Knox Counties, Ohio, Tech. Note #46; sycamore, Belmont, Holmes, Knox, Lawrence, Pike, Richland Counties, Ohio, Tech. Note #47; black cherry, Ashtabula, Monroe, Maskingum, Perry, Pike, Portage, Richland, Ross, Stark Counties, Ohio, Tech. Note #48; pin oak, Columbiana, Portage, Richland, Trumbull Counties, Ohio, Tech. Note #50; black and sugar maples, Marshall County, Indiana, Tech. Note #51; black oak, Holmes County, Ohio, Tech. Note #52; northern red and scarlet oaks, Franklin County, Ohio, Tech. Note #53.

Dates wrong on some Tech. Notes

30, 31, 33, 35, 36, 37, 39, 40,  
 41, 42, 43, 44, 45, 46, 47,  
 48, 50, 51, 52, 53



Articles Accepted for Publication

1. Chapman, A. G. Forests of the Illinoian till plain of southeastern Indiana and their composition. Ecology.
2. Cummings, W. H. Exposure of roots of shortleaf pine planting stock.
3. \_\_\_\_\_. Effects of pruning after two years on stem form of planted shortleaf pine. Jl. For.
4. Hall, J. Alfred. What a man needs -- he takes. American Forests.
5. \_\_\_\_\_. Lumber for Midwest farmers. Indiana Farmers' Guide, Wallace's Farmer, Kentucky Farmers Home Journal, Missouri Farmer, Missouri Ruralist, Ohio Farmer.
6. Kramer, Paul D. and Edward E. Sturgeon. Transect method of estimating forest area from aerial photograph index sheets. Jl. For.
7. Knessel, John G. An Ohio farmer thinks of forestry. Ohio State Orange Monthly.
8. \_\_\_\_\_. Response of chestnut oak reproduction to cutting. Jl. For.
9. Liming, F. G. Blackjack oak in the Missouri Ozarks. Jl. For.
10. McLintock, T. F. Stratification as a means of improving results of direct seeding of pines. Jl. For.



Other Completed Manuscripts

1. Anten, J. T. Some ecological aspects of the central hardwood forest, with special reference to the soil profile.
2. \_\_\_\_\_. Response of shortleaf and pitch pines to soil amendments and fertilizers in newly established nurseries in the Central States.
3. \_\_\_\_\_. Base-exchange relations of some central hardwood forest soils.
4. Chapman, A. G. A test of shortleaf pine stock classes for type conversion planting in the Missouri Ozarks.
5. Cummings, W. H. Nutrition of black locust in fertilized field plantings.
6. Liming, F. G. Reproduction in oak-hickory forest stands of the Missouri Ozarks.
7. Worthington, Robert E., Besse B. Day, and J. A. Putnam. Northern Illinois Farm Woodlands.



## STATION PERSONNEL

### Administration

J. Alfred Hall  
Bernice D. Dillon  
Robert E. Kemer  
Jeanne F. Gresh  
Charlotte D. Hoston  
Mildred C. Breese  
Mary L. Posey  
Walter S. Krysiak  
Ervin Hollingshead

Director  
Principal Clerk  
Statistical Clerk  
Asst. Clerk-Steno.  
Asst. Clerk-Steno.  
Jr. Clerk  
Jr. Steno.  
Messenger  
Janitor

### Forest Management

Arthur G. Chapman, In Charge

Silviculturist

#### Silvicultural Investigations:

John T. Auten  
Franklin G. Liming  
John G. Kuenzel

Silviculturist  
Assoc. Silviculturist  
Asst. Silviculturist

#### Mensuration Investigations:

Leonard F. Kellogg  
Don L. Hummel 1/

Silviculturist  
Jr. Agr. Aid

#### Regeneration Investigations:

Arthur G. Chapman  
Richard D. Lane 2/

Silviculturist  
Asst. Agr. Aid

### Economics

Robert E. Worthington

Forest Economist

1/ July  
2/ July - Sept., incl.



## Flood Control Surveys

Ralph K. Day 1/  
 William Burke Cummings 2/  
 Eugene D. Marshall 3/  
 Hugo W. Richman 4/  
 Orren M. Wood 5/  
 Paul R. Kramer 6/  
 James G. Iye 7/  
 Edward E. Sturgeon 8/

Silviculturist  
 Assistant Silviculturist  
 Assistant Forester  
 Assistant Forester  
 Assistant Silviculturist  
 Agricultural Aid  
 Agricultural Aid  
 Agricultural Aid

- 1/ Detailed to B.A.E., Milwaukee, 7/1/41
- 2/ Furloughed 9/15/41
- 3/ Furloughed 9/27/41
- 4/ Detailed S.C.S., Little Sioux Survey, Cherokee, Iowa, 4/15/41
- 5/ Furloughed 8/27/41
- 6/ March - June, inclusive
- 7/ February - May, inclusive

### Overhead - Indirect

Dr. Hall \$500.00  
 Boston 1740.00  
 Rent, etc. 2790.00  
 Travel, Hall 350.00  
 S&M Freight 475.00  
 Janitor 240.00  
 Carstaker 60.00

\$11,755.00

### \*\*Direct

Gresh \$1600.00  
 Posey 1500.00  
 Breeze 1500.00  
 Emmer 1800.00  
 Messenger 1080.00

\$7500.00



# 1. Direct and indirect cost by financial projects.

Financial project	Indirect project costs (overhead)	Direct project costs	Total costs
Forest Management	11,800.00 *	27,600.00 **	39,400.00
Forest Economics	3,900.00	4,600.00	8,500.00
TOTAL	15,700.00	32,200.00	47,900.00
Coop. Farm Forestry		2,000.00	2,000.00
GRAND TOTAL	15,700.00	34,200.00	49,900.00

# 2. Distribution of direct costs by main projects.

	:	:	Scientific:	Travel	:	:	:
Financial and	:	Car	equipment	expenses	:	Salaries	:
work project	:	mainten-	and project	other than:	:	:	Total
	:	ance	supplies	car	:	Regular	Temporary:
	:	:	:	:	:	:	:
Forest Management	:	:	:	:	:	:	:
Silviculture	:	580.00:	100.00	:	610.00:	17,050.00:	120.00:
Measurement	:	100.00:	50.00	:	300.00:	3,700.00:	:
Regeneration	:	320.00:	70.00	:	150.00:	4,050.00:	400.00:
TOTAL	:	1,000.00:	220.00	:	1,060.00:	24,800.00:	520.00:
	:	:	:	:	:	:	:
	:	:	:	:	:	:	:
Forest Economics	:	:	:	:	:	:	:
Private Forestry:	:	100.00:	100.00	:	400.00:	3,300.00:	200.00:
TOTAL	:	100.00:	100.00	:	400.00:	3,300.00:	200.00:
	:	:	:	:	:	:	:
	:	:	:	:	:	:	:
Coop. Farm For.	:	:	2,000.00	:	:	:	:
	:	:	:	:	:	:	:
	:	:	:	:	:	:	:
GRAND TOTAL	:	1,100.00:	2,320.00	:	1,460.00:	28,600.00:	720.00:
	:	:	:	:	:	:	:
	:	:	:	:	:	:	:

## \*Overhead - Indirect

Dr. Hall	\$5800.00
Huston	1740.00
Rent, etc.	2790.00
Travel, HALL	350.00
S&M; Freight	475.00
Janitor	540.00
Caretaker	60.00
	11,755.00

## \*\*Direct

Grosh	\$1620.00
Posey	1500.00
Breese	1500.00
Emmer	1500.00 (10 mos.)
Messenger	1080.00
	7200.00



January 30, 1942

SEED STUDIES

Field Division: Forest Management

Work Project: Regeneration

Line Project: Seed Studies

Purpose: To evaluate seed characteristics and behavior in relation to nursery stock production and to field plantation performance.

Review of Past Work: (a) First work, 1933-1935 involved comparison of physical characteristics of native pine and hardwood seed from different sources. (b) Station Notes 1, 2, 26, 27 and 28 describe treatments of black locust fruits and seed. (c) Effectiveness of scarification upon germination of black locust seed reported in Journal of Forestry (34:1). (d) Relation of composition and structure of black locust seed coats to water absorption determined.

Accomplishments During 1941: (a) Retarding effects of high calcium and low hydrogen soil media on germination and early development of shortleaf pine reported in Plant Physiology (16:2). (b) Seed descriptions written for some hardwood species for seed manual.

Plans for 1942: (a) Further work on seed manual. (b) Publication of manuscript on composition and structure of black locust seed coat.

Date of Completion: Indefinite.

Assignment: A. G. Chapman.



January 30, 1942

PLANTING

Field Division: Forest Management

Work Project: Regeneration

Line Project: Planting

Purpose: To determine the most effective procedures in establishment of satisfactory forest covers by direct seeding and planting of indigenous conifers and hardwoods under Central States conditions.

Review of Past Work: (a) Results of 1934 plantation survey to observe relation of planted species performance to site and to distribution of natural vegetation were published in Ecology 15:1 and Station Notes 15 and 29. (b) Planting age classes of indigenous pines under old field conditions and in cull stands has continued since 1933. (c) Direct seeding of pine species in old fields in Ohio since 1936 shows value for cover establishment. (d) Only very limited control of rodent pilferage has resulted from tests of over one hundred materials applied to direct seeded large fruited hardwoods. (e) Fertilizer applications, tests begun in 1936, on planted trees effect differential responses between species of pines and hardwoods. (f) Methods of planting including ground preparation and preplanting treatments of stock conducted since 1936. Technical Note 23. (g) Problems of reforestation research, J1. of Forestry, 39:3.

Accomplishments During 1941: (a) With exception of minor problems, studies on establishment of indigenous pines have been concluded. (b) Field work was completed on series of direct seeding studies of pines to evaluate method in cover establishment. Manuscript on superior performance of stratified seed over dry seed in spring spotting completed. (c) Effects of different periods of shortleaf pine root exposure in field plantings demonstrated. Manuscript complete. (d) Shortleaf pine in conversion planting, manuscript complete. (e) Three years of shortleaf pine stock grade testing show correlation of caliper and height to survival and growth rate. (f) Underplanting of different ground covers with species of hardwoods indicate relative values of protective covers, expressed by differential survival and growth. (g) Field work on fertilizer tests terminated. Two manuscripts complete. (h) Beneficial effects of screen protection on planted yellow poplar reported in Tech. Note #28.

Plans for 1942: No new studies to be initiated. Efforts to be focused on continuation of existing studies and in organizing completed, interpreted data in reports.

Date of Completion: Indefinite.

Assignment: A. G. Chapman.



January 30, 1942

SILVICS (Natural Regeneration)

Field Division: Forest Management

Work Project: Silviculture

Line Project: Silvics (Natural Regeneration)

Purpose: To study effects of physiological and environmental factors on natural regeneration.

Review of Past Work: (a) Study of value of acorn crops in Oaks was made (Jl. For. 37:11). (b) Ten-year investigation of reproduction in Indiana grassed woodlots after exclusion of livestock has been reported (Vardue Agr. Exp. Sta. Bul. 451). (c) Condition, origin, growth rate, and stocking of reproduction in Missouri Oaks has been analyzed. (d) Responses of both hardwood and shortleaf pine reproduction, sprout and seedling, to different degrees of release have been determined. (e) Origin of oak sprouts and methods of controlling sprouting, including types of girdling and stump treatments, have been effectively studied.

Accomplishments During 1941: Manuscripts completed on (a) response of chestnut oak seedlings to release; (b) condition, origin, growth rate, and stocking of reproduction in oak-hickory stands in Missouri Oaks, and (c) growth rates of sprouts from cut and uncut hardwood reproduction and planted pine in released plantations; (d) Completed five-year counts on hardwood reproduction in old fields. Data compiled from study on release of different aged pine plantations.

Plans for 1942: Prepare report on (a) origin and development of dormant buds in oaks, (b) effect of seedbed preparation and release on establishment and growth of shortleaf pine, (c) effect of release on different aged pine plantations, and (d) hardwood invasion of old fields in five-year period.

Date of Completion: Indefinite.

Assignment: F. G. Lining and John G. Kuenzel.



MS - CS

**SILVICULTURE**

**Silvics**

**(Condition and Ecology of Stands)**

January 30, 1942

**SILVICS (Condition and Ecology of Stands)**

**Field Division:** Forest Management

**Work Project:** Silviculture

**Line Project:** Silvics (Condition and Ecology of Stands)

**Purpose:** To ascertain condition and potentialities of trees in present stands, distribution and silvical characteristics of economic species, and ecology of stands as basis for management.

**Review of Past Work:** (a) Results of studies on causes and extent of defect in hardwood stands have been reported (Iowa Agr. Exp. Sta. Bul. 269 and Sta. Note #38). (b) Distribution of height increment over growing season for pine and oak in Missouri stands has been determined (Jl. For. Art. 35:1). (c) Successional changes in blackjack oak stands were made to determine rate of recovery. (d) Type mapping has been extended to include shortleaf pine of Missouri and forest and old field covers of all Branch Station land.

**Accomplishments During 1941:** (a) Manuscripts completed on natural conversion in blackjack oak stands in Missouri and forests of the Illinoian till plain of southeastern Indiana and their composition. (b) Inventory records for Sylamore Forest compiled and report prepared. (c) Field methods for detailed study in evaluation of sapling and pole-sized trees developed. (d) Dendrometer with vernier for measuring small changes in tree diameter developed and tested.

**Plans for 1942:** (a) Prepare Sylamore inventory report for publication. (b) Determination of height and diameter growth periods of pine and oak saplings and poles over growing season for comparison with those of reproduction already completed. (c) Work will be continued on condition and growth capacity of young stands in Missouri.

**Date of Completion:** Indefinite.

**Assignment:** F. G. Lining and John G. Kuenzel.



RS - CS  
SILVICULTURE  
Stand Improvement

January 30, 1942

STAND IMPROVEMENT

Field Division: Forest Management

Work Project: Silviculture

Line Project: Stand Improvement

Purpose: To study effects of various stand improvement measures, thinning, liberation, and pruning on growth, quality and composition of stands.

Review of Past Work: (a) Effects of thinning and overhead release in deteriorated oak-hickory-pine stands on growth of residual stand studied on Sylamore Forest since 1934. (b) Pruning of 5-year-old planted shortleaf and pitch pines on Kaskaskia Experimental Forest studied since 1938. Effects of differential pruning recorded in terms of growth rate, stem form, and sprouting of pruned stem. (c) Pruning crop trees in oak-hickory pole stands in southern Iowa started in 1940. (d) Saws developed for shallow girdling.

Accomplishments During 1941: (a) Manuscripts completed on effect of differential pruning of shortleaf pine on stem form and on description of girdling saws. (b) Pruning studies expanded to include effect of season of pruning on formation of sprouts on pruned stems of young planted pitch pine.

Plans for 1942: (a) Analyze and compile data on thinning and release study on Sylamore Forest. (b) To make biennial observations on pruned shortleaf and pitch pine plantings and extend pruned height of treated trees.

Date of Completion: Indefinite.

Assignment: F. G. Liming and John G. Kuenzel.



January 30, 1943

HARVEST CUTTINGS

Field Division: Forest Management

Work Project: Silviculture

Line Project: Harvest Cuttings

Purpose: To develop and evaluate methods of harvesting merchantable products in second-growth forest stands from standpoint of natural regeneration of desired species, quality of wood, growth rate of residual stand, and maximum use of forest products.

Review of Past Work: (a) Growth and mortality have been observed periodically since 1929, in a selectively cut hardwood stand in Indiana. Growth rate of white oak was increased by cut. (b) Logging damage in selectively cut mixed upland hardwood stands in Illinois was published in *Journal of Forestry*, 35:12, 1937. (c) Study of selectively cut mixed hardwood-shortleaf pine stand on Sylamore Experimental Forest, Arkansas, started in 1940. Pine and low-grade oaks were cut. Emphasis placed on condition of stand before and after cutting and correlation of external characteristics of harvested tree and the amount and quality of products into which they were sawn. Over-all cutting, skidding, loading, and hauling costs were kept.

Accomplishments During 1941: (a) Growth and mortality data for selectively cut stand in Indiana over a 10-year period following cutting were compiled and analyzed. (b) Preliminary report was prepared on an example of harvesting and utilizing shortleaf pine and low-grade hardwood stands on Sylamore Experimental Forest.

Plans for 1942: (a) Complete manuscript on products sawed from harvested trees and condition of stand before and after cutting on selectively cut stand in Arkansas. (b) Prepare report on 10-year mortality and growth in selectively cut upland hardwood stand in Indiana. (c) Initiate study in well-stocked, many-aged, protected upland hardwood stand in southern Indiana to ascertain stand condition before and after harvest- and stand-improvement cuttings designed to put the stand in best possible silvicultural condition. Record costs and returns from cutting operation and establish permanent plots to study subsequent growth and mortality in residual stand.

Date of Completion: Indefinite.

Assignment: F. G. Lining and John G. Kuenzel.



RS - 63  
MEASUREMENT  
Tree Studies

January 30, 1942

TREE STUDIES

Field Division: Forest Management

Work Project: Mensuration

Line Project: Tree Studies

Purpose: (a) To provide needed volume tables for commercial species in the Central States. (b) To provide converting factors, form, and other data to facilitate inventories of products measured in different unit volumes.

Review of past work: (a) Some 22 local volume tables and 14 standard volume tables for hardwoods in plantation and natural stands have been prepared. (b) Stave bolt data for 39-inch bolts evaluated and reported for conversion factor to be used in converting from stave content to board-foot content.

Accomplishments During 1941: (a) Prepared 63 local volume tables for Ohio Survey, 17 standard tables from Ohio data, and general tables in cooperation with Purdue University and Shawnee National Forest. (b) 324 shortleaf pine and oak measurements taken on Sylamore Forest for volume tables.

Plans for 1942: Cooperation with Ohio Survey to enhance value of reconnaissance and with National Forests and State agencies as demands arise will be continued. Conversion factor study on Clark and Mark Twain Forests will be completed. Volume tables now in preparation from Ohio Survey data will be issued.

Date of Completion: Indefinite.

Assignment: L. F. Kellogg and John G. Kuenzel.



RS - CS  
MEASUREMENT  
Stand Studies

January 30, 1942

STAND STUDIES

Field Division: Forest Management

Work Project: Measurement

Line Project: Stand Studies

Purpose: To determine growth and yield of even- and uneven-aged natural forest stands and of planted stands.

Review of past work: (a) Yield studies of planted black-walnut and black locust completed. (b) Growth studies initiated cooperatively with Purdue University, 1930-34, in farm woods in northern Indiana. (c) Relative growth rates for hardwood, hardwood-pine, and pine stands on Sylvania Experimental Forest determined.

Accomplishments During 1941: (a) Sylvania growth data for hardwood and pine reported in mimeographed form. (b) Same 40 northern Indiana growth plots remeasured at end of 10-year period. (c) Progress made on black walnut and black locust plantation manuscripts.

Plans for 1942: (a) Compile report on Kaskaskia Experimental Forest growth studies. (b) Recast mimeographed report of Sylvania for publication. (c) Complete manuscripts for black walnut and black locust plantation growth and yield studies. (d) Growth studies will be made in connection with site evaluation investigations.

Date of Completion: Indefinite.

Assignment: L. F. Kellogg and John G. Kuenzel.



RE - CS  
FINANCIAL ASPECTS  
Private Forestry

January 30, 1943

FARM WOODLANDS: Development of Methods of  
Management and Marketing

Field Division: Forest Economics

Work Project: Financial Aspects

Line Project: Farm Woodlands: Development of methods of management and marketing in the Central States

Purpose: To determine the possibilities of economic organization to increase the yield, income, and rural social benefits dependent upon farm woodlands. It involves study of organization of owners for cooperative management and marketing, and the development of sound woods practices in order to maintain farm woodlands in productive condition.

Review of Past Work: Field work during 1938 and 1939 sampled farms, woodland and nonwoodland, in Corn Belt area of northwestern Ohio and northern Illinois. Main objectives: Character and productivity of woodland growing stock, use of forest products on farms, kind of local processing plants, Illinois field work in cooperation with University, in Illinois studied farm buildings and pastures. Analysis of Illinois woodland data in Washington Office.

Accomplishments During 1941: Manuscript prepared for woodland section of Illinois report after compilation of farm use and marketing data. Manuscript mimeographed by University of Illinois under cooperative agreement. Compilation of Illinois pasture and building information in Washington Office. Manuscripts substantially complete on these phases.

Plans for 1942: Completion of work at hand on Illinois report. Manuscript for Ohio data. Time as needed for collection 1941 forest product volume and prices in Station territory for Bureau of Census. Study of acquisition of raw material, processing, and marketing by present mill organizations in specific areas in unglaciated section of Station's territory, followed by or coincident with formulation of an analysis of general economic problems of forestry for the Station.

Date of Completion: Not known.

Assignment: Robert E. Worthington.